

## Research brief

# Size-resolved characteristics of inorganic ionic species in atmospheric aerosols at a regional background site on the South African Highveld North-West University's research published in Journal of Atmospheric Chemistry

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Atmospheric aerosols or particulate matter (PM) are important components of the atmosphere with high temporal and spatial variability, which can have significant impacts on air quality and climate change. Detailed physical and chemical characterisation are crucial in establishing the impacts of atmospheric aerosol. Aerosols consist of organic and inorganic species, and the composition and concentration of these species depends on their sources, chemical transformation and sinks. In this study an assessment of major inorganic ions determined in three aerosol particle size ranges, i.e. PM<sub>1</sub>, PM<sub>1-2.5</sub> and PM<sub>2.5-10</sub> collected for one year at Welgegund was conducted.

Sulphate (SO<sub>4</sub><sup>2-</sup>) and ammonium (NH<sub>4</sub><sup>+</sup>) dominated the PM<sub>1</sub> size fraction, while SO<sub>4</sub><sup>2-</sup> and nitrate (NO<sub>3</sub><sup>-</sup>) dominated the PM<sub>1-2.5</sub> and PM<sub>2.5-10</sub> size fractions. SO<sub>4</sub><sup>2-</sup> had the highest contribution in the two smaller size fractions, while NO<sub>3</sub><sup>-</sup> had the highest contribution in the PM<sub>2.5-10</sub> size fraction. SO<sub>4</sub><sup>2-</sup> and NO<sub>3</sub><sup>-</sup> levels were attributed to the impacts of aged air masses passing over major anthropogenic source regions. Comparison of inorganic ion concentrations to levels thereof within the western Bushveld Igneous Complexes – a source region influencing Welgegund – indicated higher levels of most inorganic species within the source region. However, the comparative ratio of SO<sub>4</sub><sup>2-</sup> was significantly lower due to SO<sub>4</sub><sup>2-</sup> being formed distant from SO<sub>2</sub> emissions and submicron SO<sub>4</sub><sup>2-</sup> having longer atmospheric residencies. Aerosols at Welgegund were determined to be generally acidic, which was mainly attributed to high concentrations of SO<sub>4</sub><sup>2-</sup>.

PM<sub>1</sub> and PM<sub>1-2.5</sub> fractions revealed a seasonal pattern, with higher inorganic ion concentrations measured from May to September. Higher PM concentrations were attributed to decreased wet removal, more pronounced inversion layers trapping

pollutants, and increases in household combustion and wild fires during winter. Back trajectory analysis also revealed higher concentrations of inorganic ionic species corresponding to air mass movements over significant anthropogenic activities.